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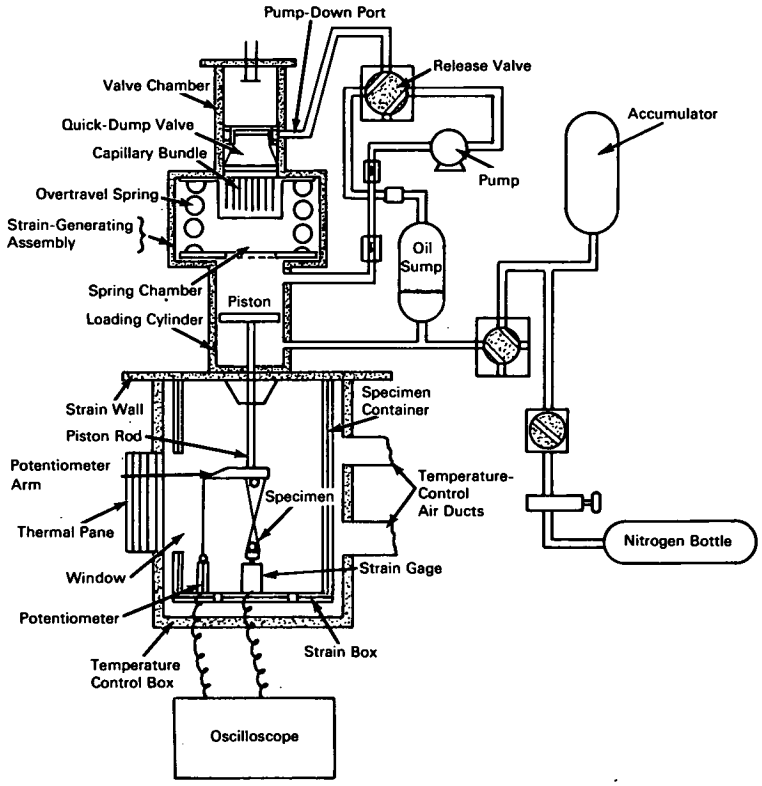
NASA TECH BRIEF

Tensile-Strength Apparatus Applies High Strain-Rate Loading with Minimum Shock



The problem:

To design an apparatus for tensile-strength testing of materials that will apply the test loads at relatively constant very high strain rates (up to 20,000 inches per minute) with minimal shock and vibration to the tensile specimen and apparatus.

The solution:

An apparatus that incorporates a capillary bundle through which a noncompressible fluid (e.g., oil) is extruded and a quick-release valve system.

How it's done:

The apparatus consists of two primary assemblies (separated by a strain wall), the strain generator, and the specimen container which is enclosed in a temperature-control box. The specimen is connected directly to the strain generator through the piston rod.

To ready the system for a test, oil is pumped under

(continued overleaf)

the quick-dump valve to drive the piston to its lower position. One of the nitrogen lines is opened to pressurize the underside of this piston, and a second nitrogen line leading to the underside of the diaphragm in the oil sump is opened. The specimen is attached to the holding devices in the strain box by opening the door in the temperature-control box and reaching in through the window in the side wall of the strain box. When the specimen is in place, the door and window are closed and the temperature is regulated to the desired degree. The preparations are completed by adjusting an orifice selector (not illustrated) associated with the valve assembly to provide the desired strain rate.

The test is begun by opening the release valve between the pressurized oil sump and the quick-dump valve. This action opens a passage for the oil trapped below the quick-dump valve. The nitrogen pressure, acting on the underside of the piston, forces the oil through the capillary bundle and constrains the piston to move upward at a constant rate, thus applying a constant tensile strain rate to the specimen. An overtravel spring in the spring chamber stops the piston at the top of its travel.

Notes:

1. The apparatus eliminates shock and vibration in high strain-rate tensile testing. It is capable of generating a constant strain rate between 20 and 20,000 inches per second.
2. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California, 91103.
   Reference: B66-10063

Patent status:

No patent action is contemplated by NASA.

Source: Harry E. Cotrill, Jr. and
W. F. MacGlashan, Jr.
under a Department of the Army contract to
Jet Propulsion Laboratory
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(JPL-28 & 29)